The treatment of recurrent anterior glenohumeral instability has been a topic of debate in the recent literature. Current operative management of shoulder instability has included a variety of open and arthroscopic surgical procedures. Open techniques for anterior reconstruction have been quite successful in preventing recurrent dislocations and continue to be the gold standard of care. In an attempt to address some of the disadvantages associated with open procedures, arthroscopic stabilization procedures have been developed. Arthroscopic capsuloligamentous repair has several clear advantages including better cosmesis, decreased peri-operative morbidity, and a possible decrease in the loss of external rotation. Advances in arthroscopic equipment and improved arthroscopic techniques have increased the popularity of arthroscopic stabilization. Recent improvements in the results of arthroscopic stabilization are related to the understanding that the Bankart lesion is not the “essential lesion” surgeons once thought. The art of diagnosing the anatomic pathology associated with instability and proper patient selection continues to evolve. Most previous reports of arthroscopic stabilization have included small numbers of patients, variable patient pathology, and a variety of surgical techniques, making comparisons between stabilization procedures difficult. Arthroscopy can be valuable in both the confirmation of the degree and severity of the instability and to potentially correct the pathoanatomy responsible for the instability.

Arthroscopic Findings

The value of diagnostic shoulder arthroscopy is generally well accepted. When used as an adjunct to open stabilization, it provides excellent information about the pathology involved, confirms or redefines a pre-operative diagnosis, and allows for treatment of intra-articular pathology. Hintermann and Gachter performed shoulder arthroscopy on 212 patients with documented shoulder dislocations. They reported a high variability in pathologic lesions associated with glenohumeral instability, including anterior glenoid labral tears (87%), anterior capsule deficiency (79%), Hill-Sachs lesions (68%), glenohumeral ligament disruptions (55%), rotator cuff tears (14%), posterior labral tears (12%), and SLAP (superior labrum, anterior to posterior) lesions (7%).1

McFarland prospectively evaluated 339 patients undergoing shoulder arthroscopy. Pre-operative examination, examination under anesthesia, arthroscopic intra-articular pathology, and the “drive-through” sign were recorded. The “drive-through” sign was positive in 69% of patients, with a sensitivity of 92% and a specificity of 37.6% for instability. The “drive-through” sign correlated with increasing shoulder laxity, but was not specific for instability.2 Therefore, many patients may have a positive drive-through sign without evidence of clinical instability.
Arthroscopic Procedures

Arthroscopic Stapling
In 1982, Detrisac and Johnson performed the first arthroscopic shoulder stabilization procedure, using a capsular stapling technique. This technique was quickly abandoned, however, because of hardware problems and an inability to address capsular laxity. Lane and colleagues retrospectively reported on 54 patients who underwent arthroscopic staple capsulorrhaphy with an average follow-up of 39 months. There was a 33% recurrence rate, with 18.5% requiring a subsequent open reconstructive procedure. Fifteen percent developed loose staples on follow-up radiographs. Only 43% of athletes were able to return to their pre-injury level of activity.

Transglenoid Suture Technique
Since Morgan and associates first described the transglenoid suture technique for repairing Bankart lesions in 1987, many authors have reported variable results. Benedetto and Glotzer reported on 31 patients with a follow-up of 2 years with no recurrences. Grana and colleagues reported on 27 patients with a follow-up of 36 months and a recurrence rate of 44.4%. Failures were attributed to plastic deformation in the capsular tissue after shoulder dislocations. Despite the repair of the Bankart, a component of the instability still existed. Seventy-five percent of these failures were in high contact athletes. Failures were also associated with immobilization periods of less than one week.

Fifty-nine patients with recurrent anterior dislocations underwent arthroscopic transglenoid suture stabilization and were followed for 49 months. Forty-nine percent developed recurrent instability. Failures in this study were associated with a positive sulcus sign, bony lesions on the anterior glenoid on radiographs, and extended ligamentous lesions. Bony deficiencies and rotator interval lesions were not addressed surgically and may have accounted for the increased recurrence rates.

Green and associates performed arthroscopic transglenoid suture fixation on 60 patients with a follow-up of 41 months; 42% experienced recurrent instability. This study classified labral lesions and correlated this classification with failure rates. In Type I, the glenoid labrum and inferior glenohumeral ligament (IGHL) complex is normal. Type II is defined by a detachment of the labrum and IGHL complex from the anterior glenoid. A Type III lesion is an intra-substance tear in the labrum. Type IV is a detached complex with degeneration and attenuation of the tissue. A Type V lesion is a completely degenerated or absent complex. Thirteen of fifteen patients with Type IV or Type V were failures in this study.

Youssef and colleagues reported on 30 patients followed for 38 months after an arthroscopic Bankart repair secondary to traumatic anterior shoulder dislocations. Twenty-seven percent experienced a recurrence of instability. All failures were male contact athletes under 35 years of age.

Caspari, in 1988, described a technique that allowed the surgeon to advance and adjust tension in the capsuloligamentous structures. He reported a 4% failure rate with a 2 to 6 year follow-up. Savoie and associates reported a prospective study of 163 patients, followed for 36 to 72 months, after a transglenoid suture reconstruction using the Caspari technique; there was a 9% failure rate. Patients younger than 18 years of age had a 26% failure rate. The vast majority (97.5%) of procedures were considered successful for patients over 22 years of age. This clinical study confirmed previous anatomic studies reporting weaker labroligamentous attachments to the glenoid in patients who were in their teenage years. In younger individuals significant healing may occur; however, it may be at a weaker level and this may increase susceptibility to recurrence.

Many have attempted to modify the Caspari technique and have experienced recurrence rates similar to those reported in the literature. Modifications have included improved preparation of the reinsertion zone on the glenoid rim, increased number of sutures, anchorage of the posterior knots directly on the spine of the scapula, the use of a biodegradable polymer button, and the use of both absorbable and non-absorbable sutures.

Pagnani and colleagues published a retrospective report with one of the longest follow-ups in the literature. They reported on 41 patients that were followed for 5 years. Nineteen percent had recurrent instability. Four of thirteen contact athletes developed instability within 2 years. The absence of a Bankart lesion was associated with a poor outcome.

Disadvantages of the transglenoid technique include the need to tie sutures over the posterior fascia, which places the suprascapular nerve at risk and does not provide secure fixation of the knots. The technique has variable success rates reported in the literature and has since been abandoned. However, it did pave the way for the development of advanced implants to avoid posterior fixation. This procedure also began to elucidate poor prognostic factors for arthroscopic stabilization. Risk factors for failed arthroscopic stabilization included males under 18 years of age, collision athletes, bone deficiencies on the glenoid, the absence of a Bankart lesion, an attenuated IGHL complex, rotator interval lesions, and short immobilization periods.

Suture Anchors
The use of suture anchors was initially described by Weber and associates. The technique was modified by both Wolf and Snyder who used absorbable and non-absorbable sutures, respectively. This technique has the advantage of allowing the capsuloligamentous structures...
to be shifted superiority and be properly tensioned. Complications regarding implants around the glenohumeral joint can occur. Silver and Daigneault reported on a patient with symptomatic intra-articular migration of a suture anchor several weeks after placement with resultant pain and articular cartilage loss on the humeral head. Kaar and colleagues reported on three of eight patients with articular damage after complications from improper placement of metallic suture anchors.

**Sutures**

Harryman and associates described a technique of reattaching the capsuloligamentous structures to the glenoid rim with sutures. This technique afforded the advantage of fixation without transglenoid drilling, metallic implants, or expensive bioabsorbable anchors. Cadaver models proved the fixation to be adequate and stable. The technique, however, is technically difficult and not routinely used at the current time.

**Biodegradable Tacks**

The use of metallic hardware around the glenohumeral joint has been consistently shown to have complications such as loosening, migration, and breakage, leading to pain and arthrosis. These problems led to the development of biodegradable tacks for the shoulder. The Suretac device is a cannulated tack molded from polyglyconate. The head and body were molded separately and then attached to each other. Reports of breakage at the junction site have compromised fixation. The device is degraded by hydrolysis and does not involve an inflammatory process from the body. Laboratory studies reveal an approximate 50% loss of strength at 2 weeks and a 100% loss at 4 weeks. Animal studies showed the heads of the tacks to be loose at 6 weeks and broken at 12 weeks.

Warner and Warren reported on 20 patients treated with arthroscopic Bankart repair using a biodegradable implant. Patients were immobilized for 4 weeks. The author found a 20% recurrence rate after 32 months. There were no complications associated with the implant. Technical pitfalls encountered when using the biodegradable anchors were studied by Warner and colleagues on cadaver shoulders. Common errors included inadequate abrasion of the glenoid rim, inadequate superior shift of the IGHL, medial placement of the anchor relative to the articular margin, and insufficient capture and compression of the capsular tissue. Initial fixation strength of bioabsorbable tacks (100 N) may be less than that of open procedures or with suture repair and, therefore, may require an initial prolonged period of immobilization.

In one case report, Burkart and associates described a foreign-body reaction to the Suretac device. This patient underwent "second look” arthroscopy, secondary to pain and decreased range of motion that occurred at nine weeks after the initial surgery. Gross examination revealed massive synovitis. Loose fragments of the tack were visualized in the joint. On histologic examination, there was an infiltration of histiocytes and multinucleated giant cells containing birefringent polymeric particles. All cultures were negative. These problems have been addressed with the development of newer tacks that have been molded as a single unit, instead of a body and head, and may increase strength. Changes in the biochemical composition of tacks may reduce the inflammatory response as well. Osteocompression tacks also may be of value, adding to the strength of the implant.

Warner and colleagues, also evaluated 15 patients with "second look” surgery after an arthroscopic stabilization using the Suretac anchor. The "second look” procedure was performed for recurrent instability or pain after an average of nine months following the index procedure. Biopsies of two patients with recurrent instability revealed residual polyglyconate polymer debris surrounded by a histiocytic infiltrate with foreign body giant cells. In the stable shoulders, the Bankart repairs had all either completely or partially healed. In the patients with recurrent instability, 43% of the Bankart lesions did not heal, and 86% had capsular laxity. Therefore, the authors stated, selection criteria are paramount for a successful outcome. Patients with unidirectional, traumatic anterior instability, with a discrete Bankart lesion and with well developed glenohumeral ligaments, who do not participate in collision athletics, are ideal for an arthroscopic procedure. Additionally, Speer and associates concluded that the procedure may be accomplished with a tack in patients who do not need capsular volume reduction.

Laurencin and colleagues used a strict criterion for indicating the procedure. Indications for selection were traumatic, unidirectional anterior instability; presence of a Bankart lesion; thin IGHL; and minimal bony erosions on the glenoid. The authors reported a 10% recurrence rate.

**Suture Anchors versus Transglenoid Fixation**

Several studies have compared results of suture anchors versus transglenoid fixation. Kandziora and associates retrospectively studied 163 patients with post-traumatic shoulder instability requiring labral fixation. Most patients (108) were stabilized with a transglenoid suture technique, with 55 patients using a FASTak™ suture anchor. The incidence of recurrence was 32.4% in the transglenoid group and 16.4% in the suture anchor group. There was a correlation between the postoperative dislocation rate and the number of preoperative dislocations and the degree of labral lesion. The learning curve with the suture anchor group was less steep than with the transglenoid technique. The transglenoid group displayed a recurrence rate of 50% when the technique was introduced. This decreased to 11.6% over the next five years. The suture anchor technique had a recurrence rate de-
crease from 22.2% to 10% over a similar period of time. The authors concluded that the suture anchor technique was superior to the transglenoid, however still inferior to the open technique reported results and that arthroscopic stabilization may be indicated in a patient with less than five preoperative dislocations.34

Tauro prospectively reported on 34 patients treated with an arthroscopic Bankart repair with a two to five year follow-up. The Bankart repair was combined with an inferior capsular split that advanced the capsule an additional 2 cm in an attempt to restored normal capsular tension. A transglenoid suture technique was used in five patients and a suture anchor technique in 29 patients. The transglenoid group had a recurrence rate of 40%, whereas the suture anchor group had a recurrence rate of 6.9%. The authors summarized that the suture anchor technique was superior to transglenoid technique, and when combined with a capsular advancement had an acceptable level of recurrence.35

**Arthroscopic Stabilization versus Open Stabilization**

Recently comparisons between open procedures and arthroscopic procedures have been reported in the literature. Green and Christensen reported that arthroscopic stabilization procedures decreased operating room time, blood loss, narcotic use, hospital stay, time lost from work, and complications when compared with open procedures.36 Comparison studies have reported rates of recurrence between 13% and 70% in the arthroscopic group and 0% and 30% in the open group.37-39 Although initial results from the arthroscopic procedures demonstrated significantly higher rates of recurrence, improvements in patient selection and operative technique have steadily decreased recurrence rates to match that of open procedures.

A prospective study on transglenoid suture repair versus open stabilization revealed a 6% recurrence rate in the open group and a 17% recurrence in the arthroscopic group over 36 to 40 months.40 Cole and colleagues reported a prospective study on arthroscopic stabilization with bioabsorbable tacks versus open repair in which patients initially had an examination under anesthesia (EUA) and diagnostic arthroscopy. Based on the findings at arthroscopy, patients were placed in the arthroscopic group or the open group. Recurrence rates were 24% for the arthroscopic group and 18% for the open group. This study concluded that both groups yielded similar results if the procedure was selected on the basis of the pathology found at the time of EUA and diagnostic arthroscopy.41

**Rotator Interval Repair**

Rotator interval tears are often associated with glenohumeral instability and interval pathology should be evaluated during arthroscopic stabilization. Arthroscopic findings consistent with rotator interval tears are capsular redundancy between the supraspinatus and subscapularis, biceps tendon fraying, superior glenohumeral ligament tears, and fraying of the superior border of the subscapularis.42 If a surgeon is not comfortable addressing this lesion arthroscopically, then an open procedure is indicated.

**Arthroscopic Treatment of Acute Initial Dislocation**

The natural history of traumatic anterior dislocations in young patients has been reported to have recurrence rates between 60% and 90%. The West Point Military Academy conducted a prospective study on non-operative versus arthroscopic Bankart repair after acute, initial dislocations. The average age of patients was 20 years. Thirty-six patients were included in the report with a follow-up of 32 months. Fifteen patients were randomized into the non-operative group consisting of one month of immobilization followed by rehabilitation. Eighty percent developed recurrent instability. Twenty-one patients were in the operative group that had a transglenoid suture repair of the Bankart lesion. Fourteen percent developed recurrent instability. Arthroscopic Bankart repair reduced the recurrence rate in young athletes after a primary acute shoulder dislocation.43

Kirkley and associates performed a prospective randomized clinical trial reporting similar recurrence rates of 15.9% in the surgical group and 47% in the rehabilitation group.44 Boszotta and Helperstorfer reported on 72 patients after a 66 month follow-up; 6.9% developed instability. Eighty-five percent resumed sporting activity at their pre-injury level. All patients with recurrence had associated capsuloligamentous injuries combined with a Bankart lesion.45 Arthroscopic stabilization for acute, primary traumatic anterior shoulder instability associated with a Bankart lesion can significantly reduce the rate of recurrence.

**Summary**

The role of arthroscopic procedures in the management of glenohumeral instability continues to evolve and represents an effective alternative for addressing the pathology associated with this condition. Patient selection criteria, operative techniques, and implants all continue to evolve and have resulted in improved rates of success. Arthroscopic procedures benefit patients by avoiding the common morbidities associated with the disruption of the anterior soft tissues, including a loss of external rotation associated with open procedures. Arthroscopic procedures remain technically demanding and require skills to address all of the existing pathology. The surgeon must be prepared to address many conditions beyond the Bankart lesions including glenoid bone lesions,
capsular laxity, rotator interval lesions, and SLAP lesions. In addition to the documentation of recurrence, the success of this procedure must be evaluated within the context of retained ranges of motion, recovery time, proprioceptive control, and the return to prior levels of activity. Further studies are necessary to continue to validate the efficacy of arthroscopic stabilization.

References

36. Green MR, Christensen KP: Arthroscopic versus open...


